

Primary or Secondary Results i 3 5

Davy/ and with him the great body of chemical philosophers (including myself), have given the appearance of copper, lead, tin, silver, gold, etc., at the negative electrode, when their aqueous solutions were acted upon by the voltaic current, as proofs that the metals, as a class, were attracted to that surface; thus assuming the metal, in each case, to be a primary result. These, however, I expect to prove, are all secondary results; the mere consequence of chemical action, and no proofs either of the attraction or of the law announced respecting their places.²

482. But when we take to our assistance the law of *constant electro-chemical action* already proved with regard to water (467), and which I hope to extend satisfactorily to all bodies (556), and consider the *quantities* as well as the *nature* of the substances set free, a generally accurate judgment of the primary or secondary character of the results may be formed: and this important point, so essential to the theory of electrolysation, since it decides what are the particles directly under the influence of the current (distinguishing them from such as are not affected), and what are the results to be expected, may be established with such degree of certainty as to remove innumerable ambiguities and doubtful considerations from this branch of the science.

483. Let us apply these principles to the case of ammonia, and the supposed determination of nitrogen to one or the other *electrode* (290, 291). A pure strong solution of ammonia is as bad a conductor, and therefore as little liable to electrolysation, as pure water; but when sulphate of ammonia is dissolved in it, the whole becomes a conductor; nitrogen *almost* and occasionally *quite* pure is evolved at the *anode*, and hydrogen at the *cathode*; the ratio of the volume of the former to that of the latter varying, but being as i to about 3 or 4. This result would seem at first to imply that the electric current had decomposed ammonia, and that the nitrogen had been determined towards the positive electrode. But when the electricity used was measured out by the volta-electrometer (442, 471), it was found that the hydrogen obtained was exactly in the proportion

¹ *Elements of Chemical Philosophy*, pp. 144, 161.

² It is remarkable that up to 1804 it was the received opinion that the metals were reduced by the nascent hydrogen. At that date the general opinion was reversed by Hisinger and Berzelius (*Annales de Chimie*, 1804, torn. li. p. 174), who stated that the metals were evolved directly by the electricity: in which opinion it appears, from that time, Davy coincided (*Philosophical Transactions*, 1826, p. 388).